CORRELATION BETWEEN REGION OF ENHANCED MARE FLOODING ON THE LUNAR FARSIDE AND APOLLO ORBITAL RESULTS

(Research Note)

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The most obvious difference between near and farsides of the Moon, as revealed by the Lunar Orbiter photography, is the prevalence of rugged, heavily cratered highland terrain and almost total absence of maria on the hidden face. A few exceptional mare-filled craters or basins are found, such as Tsiolkovsky, J. Verne, Lomonosov and Mare Moscoviense. However, a region on the lunar farside does exist, where mare-type flooding is more widespread than elsewhere. This region occurs at about 180° longitude, from 20° to 60° S (Figure 1). Areas covered, or partly covered with mare material include Aitken, Van de Graaff, Mare Ingenii, Leibnitz, Von Kármán, Apollo and some craters near Poincaré.

The Sun angle on several of the farside Lunar Orbiter V frames examined was not the optimum to delineate albedo differences, since the photographs were taken near the sunset terminator. However, the textural details observed, such as the smoothness of the crater floors, existence of 'ghost' or partly buried craters, wrinkle ridges and even low broad domes, were characteristic of features that occur on nearside maria. Therefore, these crater floors are considered to be covered with mare material – now known from the Apollo missions to consist of iron-rich basalts.

The region of enhanced mare flooding acquires additional interest as a result of the orbital experiments on the last three Apollo missions: in particular, the laser altimeter, gamma-ray spectrometer and subsatellite magnetometer.

The most unusual feature discovered by the laser altimeter on Apollo 15 was a 1400 km wide depression at about 180° longitude, that is 6 km deeper than its surroundings (Kaula *et al.*, 1972). The exact boundaries of the feature are in doubt, because no basin of this size can be readily detected on LO photographs. However, Kaula *et al.* (1972) propose that the basin is centered at 10° S and 170° W, and parts of its rim pass through Stein, the eastern edge of Coriolis and east of Heaviside (see LO II-34M). Russian data, they also point out, suggest a larger basin centered at 60° S and 180° W, which lies closer to the region of increased basalt flooding.

The 2 km offset detected by the laser altimeter between the center of mass and center of figure of the Moon toward the Earth, implies that the less-dense plagioclase-rich highland crust (Adler *et al.*, 1972) is much thicker on the farside than the nearside. The thicker crust of the farside may have prevented basaltic magmas from reaching the surface, leaving the farside 'dry'. However, the site of the laser altimeter depression

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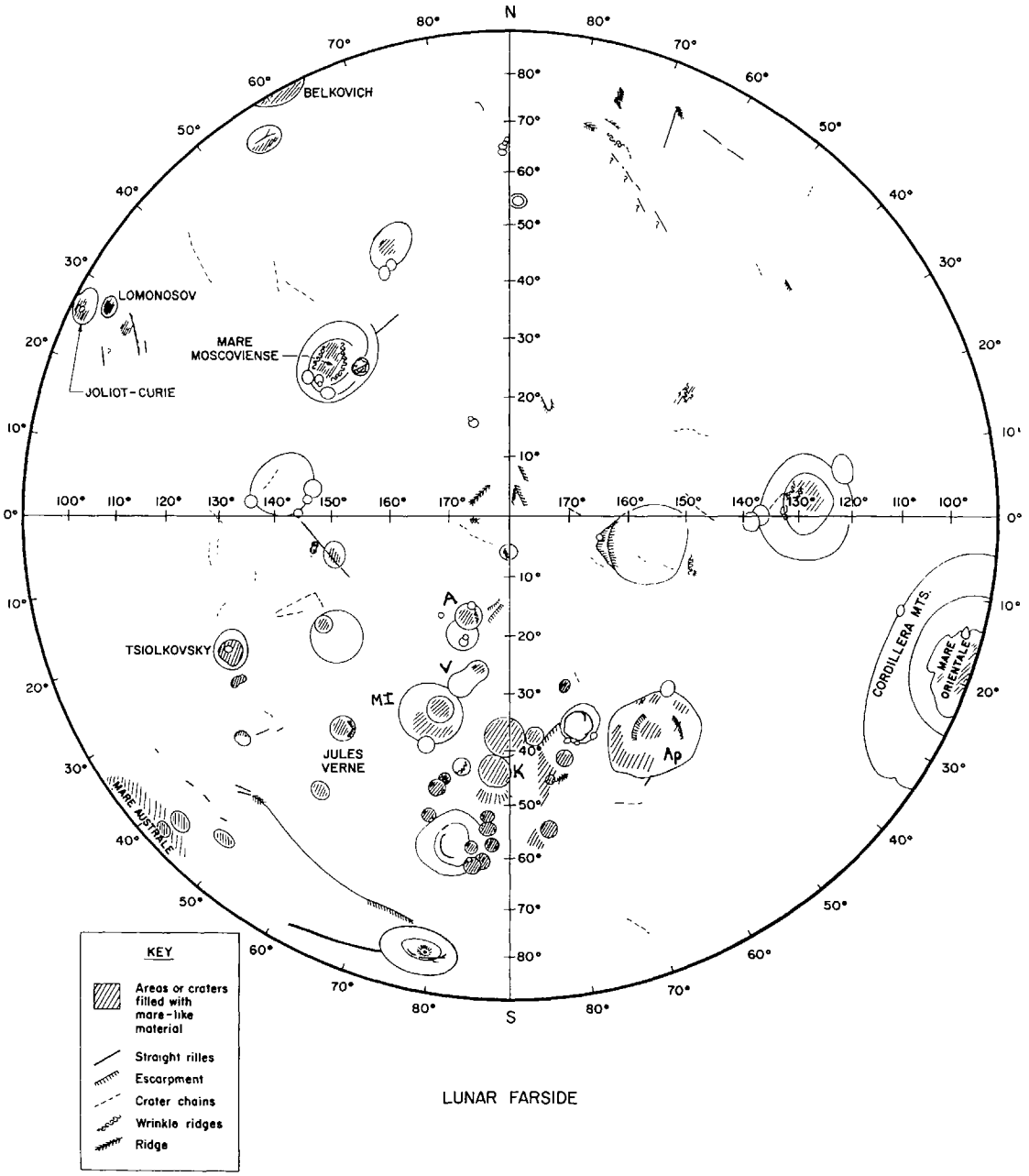

Fig. 1. A chart of the lunar farside showing areas of mare-filling (shaded). Craters discussed in text are Aitken (A), Van de Graaff (V), Mare Ingenii (MI), Von Karman (K), and Apollo (Ap).

may coincide with a region of thinner crust, where volcanic extrusions were more abundant.

Supporting evidence stems from the gamma-ray spectrometer results (Metzger *et al.*, 1972). The major concentrations of radioactive elements lie in the nearside maria, especially around Oceanus Procellarum and Mare Imbrium. The farside highlands show much lower radioactivity, except for a significant enhancement near Van de Graaff and Mare Ingenii (Trombka *et al.*, 1973). Furthermore, the craters Van de Graaff and Aitken, both mare-filled, are among the rare farside features to display

nighttime thermal anomalies (Low and Mendel, 1973). The area between these two craters is also distinguished as the site of the Moon's strongest intrinsic magnetic field, as measured by the subsatellite magnetometer (Russell *et al.*, 1973).

In summary, the Apollo orbital experiments show that a previously unknown farside depression coincides roughly with an area of enhanced radioactivity, and thermal and magnetic anomalies. Examination of Lunar Orbiter photographs reveals no giant mare basin, but does indicate a higher than average degree of mare-type filling in many craters of this region. It is suggested that the anorthositic gabbro highland crust may be thinner in this area than elsewhere on the lunar farside, thus having facilitated the extrusion of basaltic lavas. The increased abundance of mare basalts may account for the observed Apollo results.

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